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GB 2146279 A GB 0584232 A EP 0661139 A1
US 5613585 A US 5501124 A US 4290328 A
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(71) Applicant(s)
The Stanley Works Limited
(Incorporated in the United Kingdom)
Woodside, Sheffield, S3 9PD, United Kingdom

(72) Inventor(s)
Stephen Rowley

(74) Agent and/or Address for Service
Marks & Clerk
57-60 Lincoln's Inn Fields, LONDON, WC2A 3LS, United Kingdom

(54) Abstract Title
Ratchet mechanism

(57) Two pawls 58a,58b are mounted on a body 52 so as to be tiltable about axes 61a,61b parallel to the axis 11 of a spur gear 57 rotatably mounted in the body 52. The ratchet mechanism is applied to a screwdriver.

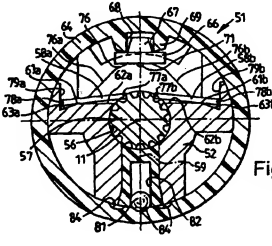

Fig. 2

GB 2 340 199 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

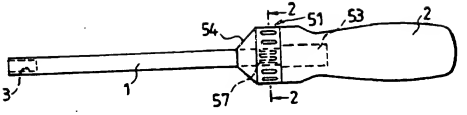

Fig. 1

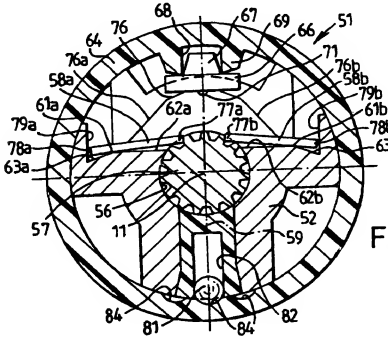

Fig. 2

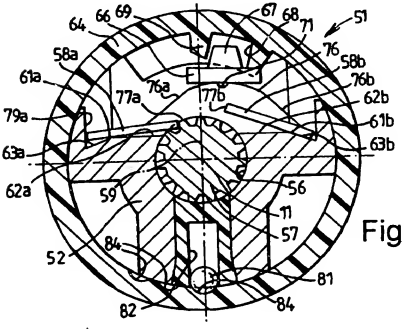

Fig. 3

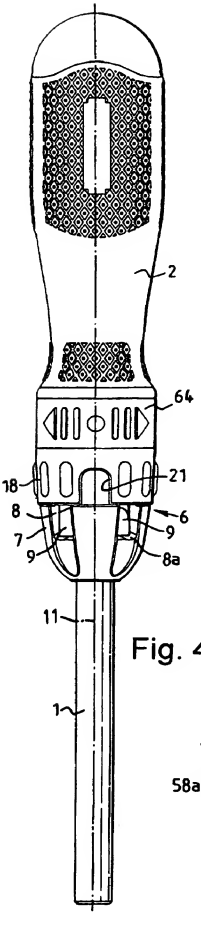

Fig. 4

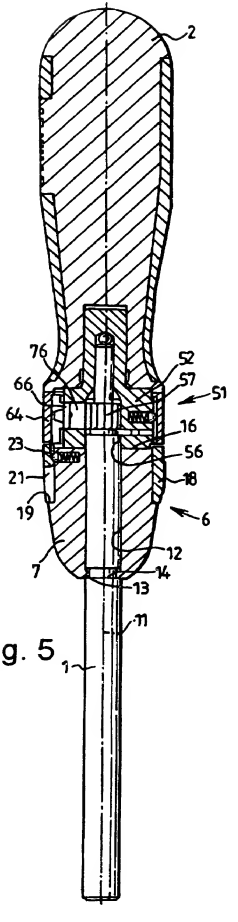

Fig. 5

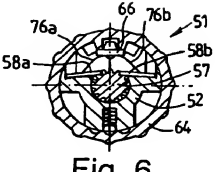

Fig. 6

RATCHET MECHANISM

This invention relates to a ratchet mechanism, in particular for a screwdriver.

Conventional ratchet mechanisms for screwdrivers have pawls which extend in the axial direction of the shaft of the screwdriver and which have narrow extensions engageable with the teeth of a gear provided on the shaft. The pawls are pushed into and out of engagement with the gear by a control member which is usually slidable in the axial direction. Such ratchet mechanisms occupy a significant proportion of the overall length of the screwdriver.

It would be desirable to be able to provide a ratchet mechanism of short axial length.

The present invention provides a ratchet mechanism comprising pawls which are mounted on a body so as to be tiltable about respective tilting axes parallel to the axis of a spur gear rotatably mounted in the body.

The invention also provides a screwdriver comprising a handle, a shaft rotatable relative to the handle, and the above-mentioned ratchet mechanism, the body being fixed with respect to the handle, and the spur gear being fixed with respect to the shaft, which has a longitudinal axis coincident with the rotation axis of the spur gear, the shaft being rotatably mounted in the body.

The invention will be described further, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side view of a multi-bit screwdriver incorporating a ratchet mechanism;

Figure 2 is a section on line 2-2 in Figure 1, the ratchet mechanism being in a locked state, in which a screw can be driven in both directions;

Figure 3 is a view similar to Figure 2, the ratchet mechanism being in a first ratcheting mode, in which a screw can be driven only in the clockwise direction;

Figure 4 is a side view of a preferred embodiment of the screwdriver;

Figure 5 is an axial section through the screwdriver of Figure 4; and

Figure 6 is a cross-section through the rotatable mechanism of the screwdriver of Figure 4.

The screwdriver shown in Figures 1 to 3 has a steel bar or shaft 1 which extends from one end of a composite plastic handle 2 having a hard polypropylene core. The distal end of the shaft has a hexagonal recess 3 for receiving the hexagonal stub of a conventional tool-bit. A permanent magnet is fixed in the base of the hexagonal recess 3 in order to retain the bit in use.

The front end of the handle 2 is provided with a reversible ratchet mechanism 51 with a die cast body 52 having a hexagonal rear extension 53 which is press fitted into the core of the handle 2. The front of the ratchet mechanism is closed by a removable cover 54.

The shaft 1 is mounted in a bore 56 in the body 52 so as to be rotatable about the longitudinal axis 11 of the shaft. A spur gear 57 is machined in the shaft, the tip cylinder of the gear substantially coinciding with the circular profile of the cylindrical shaft 1. Beyond the gear 57 the shaft has an extension of smaller diameter (not shown in Figures 1 to 3) rotatably mounted in a blind bore in the rear extension 53 of the body 52.

First and second elongate rockable pawls 58a and 58b are mounted symmetrically on the body 52 on opposite sides of an imaginary plane 59 containing the rotation axis 11. Each pawl 58a (58b) is tiltable about an axis defined by a fulcrum 61a (61b) which extends parallel to the rotation axes 11 and which is defined between two adjacent flat faces 62a and 63a (62b and 63b) formed on the body 52.

A control sleeve 64 is rotatably mounted on the body 52. A control member 66 in the form of a plate has an outward projection 67 loosely fitted in a recess 68 provided in an inwardly projecting part 69 of the control sleeve 64. Connected to the control member 66 by a rivet 71 is a leaf spring 76 having two symmetrical spring legs 76a and 76b which act on the respective pawls 58a and 58b and keep them in contact with the respective fulcrums 61a and 61b.

In Figure 2 the ratchet mechanism 51 is shown in an intermediate non-ratcheting state, in which the first and second spring legs 76a and 76b urge the first and second pawls 58a and 58b to engaging positions in which the free inner end 77a (77b) of each pawl 58a (58b) intersects the tip cylinder of the spur gear 57 and can abut against the flank of a gear tooth to prevent rotation of the gear in each direction relative to the body 52. The outer rear end 78a (78b) of each pawl 58a (58b) abuts against a face 79a (79b) formed on the body 52, to provide a reaction to the force of the gear tooth abutting against the pawl.

In Figure 3, the control sleeve 64 has been turned from the intermediate non-ratcheting position (Figure 2) in a clockwise direction, as viewed from the handle 2, to a first ratcheting position, in which the first spring leg 76a urges the first pawl 58a to the engaging position and the second spring leg acts on the part of the second pawl 58b outside the fulcrum 61b so as to urge the second pawl 58b to a non-engaging position (as shown in Figure 3) in which its free end 77b lies outside the tip cylinder of the gear 57 and the pawl rests on the sloping face 63b of the body 52. In this state of the ratchet mechanism 51 rotation of the handle 2 in the clockwise direction turns the shaft 1 in the

same direction, whereas rotation of the handle in the anti-clockwise direction does not rotate the shaft, since the lower surface of the first pawl 58a rides over the teeth of the gear 57.

Clearly, when the control sleeve 54 is turned in the anti-clockwise direction from the intermediate position of Figure 2 to a second ratcheting position which is the mirror image of the first ratcheting position shown in Figure 3, then rotation will be transmitted from the handle to the shaft only in the anti-clockwise direction.

The control sleeve 64 is located in each of its three positions by a spring loaded ball 81 which is mounted in a radial blind bore 82 in an insert 83 in the body 52 and which selectively engages in three part-spherical notches 84 inside the control sleeve 64.

Various modifications may be made within the scope of the invention. For example, the cover 54 may be removed and replaced by a tool-bit magazine.

Figures 4 to 6 show a preferred embodiment of the screwdriver, in which parts similar to those described above are given the same reference numerals. The screwdriver has a tool-bit magazine 6 with a body 7 having recesses 8 accommodating tool bits 9. The body 7 has an axial bore which is a sliding fit on the shaft 1. A portion 13 of the body 7 engages in a circumferential groove 14 machined in the shaft 1. A sleeve 18 is mounted in a circumferential recess 19 in the body 7 so as to be rotatable to respective positions in which a slot 21 is in register with a respective recess 8, to permit insertion or removal of a bit 9. A spring loaded ball 23 mounted on the body 7 engages in a circumferential series of notches in the sleeve 18.

The screwdriver shown in Figures 4 to 6 also has a ratchet mechanism 51 between the magazine 6 and the handle 2. The ratchet mechanism has a body 62 with a bore 56 receiving the shaft 1 which is formed with a spur gear 57 engageable by pawls 58a and 58b which are tiltable about axes parallel to the shaft axis 11. A control sleeve

64 is linked to a control member 66 carrying a leaf spring 76 with legs 76a and 76b which bear on the pawls 58a and 58b respectively. The control sleeve 64 is movable clockwise and anticlockwise from the intermediate position shown in Figure 6, in which both pawls 58a and 58b and engaged with the gear 57, to respective ratcheting positions in which only one or the other of the pawls is engaged with the gear 57.

The rear end surface 16 of the magazine body 7 abuts against the front surface of the body 62, against which the rear ends of the bits 9 rest. The tips of the bits 9 rest against sloping front end surfaces 8a of the recesses 8.

The magazine 6 is described in more detail in our co-pending patent application of even date entitled "Tool-bit magazine".

CLAIMS

1. A ratchet mechanism comprising:

a body;

a spur gear mounted in the body so as to be rotatable about a rotation axis relative to the body;

first and second pawls mounted on the body so as to be tiltable about respective tilting axes parallel to the rotation axis and on opposite sides of an imaginary plane containing the rotation axis, each pawl having a free end between its tilting axis and the said plane; and

resilient means for tilting each pawl between an engaging position, in which its free end intersects the tip cylinder of the spur gear and can abut against the flank of a gear tooth to prevent rotation of the gear in one direction relative to the body, and a non-engaging position, in which its free end lies outside the tip cylinder.

2. A ratchet mechanism as claimed in claim 1, in which each pawl is tiltable on a fulcrum on the body, the fulcrum defining the tilting axis of the pawl.

3. A ratchet mechanism as claimed in claim 2, in which the resilient means keeps the pawls in contact with the respective fulcrums.

4. A ratchet mechanism as claimed in claim 2 or 3, in which each pawl has a rear end which is on the opposite side of the fulcrum with respect to the free end and which abuts against the body to provide a reaction to the force of a gear tooth abutting against the pawl when the pawl is in the engaging position.

5. A ratchet mechanism as claimed in any preceding claim, in which the resilient means comprises a control member having first and second spring legs, the control member being movable to a first ratcheting position, in which the first leg urges the first pawl to the engaging position and the second leg urges the second pawl to the non-engaging position, a second ratcheting position, in which the first leg urges the first

pawl to the non-engaging position and the second leg urges the second pawl to the engaging position, and an intermediate non-ratcheting position, in which both legs urge both pawls to the engaging position.

6. A ratchet mechanism as claimed in claim 5, including a control sleeve rotatably mounted on the body, the control member being linked to the control sleeve so that rotation of the control sleeve clockwise and anticlockwise from a given position moves the control member from the intermediate non-ratcheting position to the first and second ratcheting positions respectively.

7. A ratchet mechanism as claimed in claim 6, in which the control member has an outward projection loosely fitted in a recess inside the control sleeve.

8. A screwdriver comprising a handle, a shaft rotatable relative to the handle, and a ratchet mechanism according to any preceding claim, the said body being fixed with respect to the handle, and the said spur gear being fixed with respect to the shaft, which has a longitudinal axis coinciding with the rotation axis, the shaft being rotatably mounted in the body.

9. A ratchet mechanism substantially as described with reference to, and as shown in, Figures 1 to 3 or Figures 4 to 6 of the accompanying drawings.

10. A screwdriver substantially as described with reference to, and as shown in, Figures 1 to 3 or Figures 4 to 6 of the accompanying drawings.

The Patent Office

3

Application No:	GB 9816878.4	**Examiner:**	Jason Clee
Claims searched:	1 to 10	**Date of search:**	5 March 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F2Q
B3N: N7B & N9K

Int Cl (Ed.6): B25B: 13/46 & 15/04
F16H: 31/00

Other: Online: WPI, EPODOC & PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2146279 A	(Chen, C.) especially see figure 1	1-3
X	GB 0584232 A	(Abingdon King Dick Limited) especially see page 3 lines 101 to 110 and the figures	1-5
X	EP 0661139 A	(Snap-on Incorporated) especially see the abstract and figures	1 & 8
X	US 5613585 A	(Beere Precision Medical Instruments Inc.) especially see figure 5	1, 2, 5, 6 & 8
X	US 5501124 A	(Ashby, E. T.) especially see the abstract and figures	1-3
X	US 4290328 A	(Vermont American Corp.) especially see the abstract and figures	1-3, 5 & 8
X	US 3575069 A	(White, K. C.) especially see the absract and figures	1-3

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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